

Patent claims:

AGR 99/M 224 US

1. A transgenic plant cell which is genetically modified, the genetic modification leading to a decrease in the activity of one or more GBSSI proteins occurring endogenously in the plant cell and to a decrease in the activity of one or more BE proteins occurring endogenously in the plant cell, in comparison to corresponding non genetically modified plant cells of wild-type plants.
2. The transgenic plant cell as claimed in claim 1, the genetic modification consisting in the introduction of one or more foreign nucleic acid molecules, whose presence and/or expression leads to a decrease in the activity of GBSSI and BE proteins, in comparison to corresponding non genetically modified plant cells of wild-type plants.
3. The transgenic plant cell as claimed in claim 1, in which the presence and/or the expression of one or more foreign nucleic acid molecules leads to the inhibition of the expression of endogenous genes which encode GBSSI and BE proteins.
4. The transgenic plant cells as claimed in claim 2 or 3, in which said foreign nucleic acid molecules are selected from the group consisting of
 - a) DNA molecules which encode at least one antisense RNA which brings about a decrease in the expression of endogenous genes encoding GBSSI and/or BE proteins;
 - b) DNA molecules which lead, via a cosuppression effect, to a decrease in the expression of endogenous genes encoding GBSSI and/or BE proteins;
 - c) DNA molecules which encode at least one ribozyme which specifically cleaves transcripts of endogenous genes encoding GBSSI and/or BE proteins; and
 - d) nucleic acid molecules, introduced by means of in-vivo mutagenesis, which lead to a mutation or insertion of a heterologous sequence in

endogenous genes encoding GBSSI and/or BE protein, the mutation or insertion bringing about a decrease in the expression of GBSSI and/or BE genes or the synthesis of inactive GBSSI and/or BE proteins.

- 5 5. The transgenic plant cell as claimed in claim 1, said BE protein being a BEI protein and/or the BE gene being a BEI gene.
6. The transgenic plant cell as claimed in claim 1, which synthesizes a modified starch.
- 10 7. The transgenic plant cell as claimed in claim 6, which contains a modified starch having an amylopectin content of at least 90% and in comparison to starch from plant cells of corresponding plants of the waxy phenotype has an increased phosphate content.
- 15 8. A process for the production of a transgenic plant cell which synthesizes a modified starch, in which
a plant cell is genetically modified by the introduction of one or more foreign nucleic acid molecules, whose presence and/or expression lead/leads to a
20 decrease in the activity of GBSSI proteins and to a decrease in the activity of BE proteins.
- 25 9. A process for the production of a transgenic plant cell whose starch has an amylopectin content of at least 90% and an increased phosphate content in comparison to starch from corresponding plants of the waxy phenotype, in which
a plant cell is genetically modified by the introduction of one or more foreign nucleic acid molecules, whose presence and/or expression lead/leads to a
30 decrease in the activity of GBSSI proteins and to a decrease in the activity of BEI proteins.

10. A process for the production of a transgenic plant which synthesizes a modified starch, in which
- 5 a) a plant cell is genetically modified by the introduction of one or more foreign nucleic acid molecules whose presence and/or expression lead/leads to a decrease in the activity of GBSSI proteins and to a decrease in the activity of BE proteins;
- b) a plant is regenerated from the cell produced according to step a); and, if appropriate, further plants are produced from the plants produced according to step b).
- 10 11. A process for the production of a transgenic plant whose starch has an amylopectin content of at least 90% and an increased phosphate content in comparison to starch from corresponding plants of the waxy phenotype, in which
- 15 a) a plant cell is genetically modified by the introduction of one or more foreign nucleic acid molecules, whose presence and/or expression lead/leads to a decrease in the activity of GBSSI proteins and to a decrease in the activity of BEI proteins;
- 20 b) a plant is regenerated from the cell produced according to step a); and, if appropriate, further plants are produced from the plants produced according to step b).
12. A transgenic plant containing plant cells as claimed in claim 1.
- 25 13. The transgenic plant as claimed in claim 12, which is a starch-storing plant.
14. The transgenic plant as claimed in claim 12, which is a potato plant.
15. The reproductive material of plants as claimed in claim 12, containing plant
- 30 cells as claimed in claim 1.

16. The use of one or more foreign nucleic acid molecules which encode proteins having the enzymatic activity of GBSSI and BE proteins or their fragments for the production of plant cells as claimed in claim 1 or of plants as claimed in claim 12.

5

17. The use of one or more foreign nucleic acid molecules which encode proteins having the enzymatic activity of GBSSI and BEI proteins or their fragments for the production of plants as claimed in claim 12, which synthesize a modified starch which, in comparison to starch from corresponding plants of the waxy phenotype, has an increased phosphate content and/or a decreased gelatinization temperature.

10

18. The use of one or more foreign nucleic acid molecules for the production of plants as claimed in claim 12, which synthesize a starch having an amylopectin content of at least 90%, which, in comparison to starch from corresponding plants of the waxy phenotype, has an increased phosphate content and/or a decreased gelatinization temperature, the foreign nucleic acid molecule being a molecule or the foreign nucleic acid molecules being a number of molecules selected from the group consisting of:

15

20

a) DNA molecules which encode at least one antisense RNA which can bring about a decrease in the expression of endogenous genes encoding GBSSI and/or BEI proteins;

25

b) DNA molecules which lead, via a cosuppression effect, to a decrease in the expression of endogenous genes encoding GBSSI and/or BEI proteins;

c) DNA molecules which encode at least one ribozyme which specifically cleaves transcripts of endogenous genes encoding GBSSI and/or BEI proteins; and

30

d) nucleic acid molecules introduced by means of in-vivo mutagenesis, which lead to mutations or insertions of heterologous sequences in endogenous genes encoding GBSSI and/or BEI proteins, the mutation or insertion bringing about a decrease in the expression of the GBSSI

and/or BEI genes or the synthesis of inactive GBSSI and/or inactive BEI proteins.

- 5 19. A composition containing at least one of the nucleic acid molecules as defined in claims 2 to 5 or 16 to 18, which is suitable for the production of transgenic plant cells as claimed in claim 1.
- 10 20. The composition as claimed in claim 19, the presence of said nucleic acid molecules in said plant cells leading to a decrease in the activity of GBSSI proteins occurring endogenously in the plant cell and to a decrease in the activity of BE proteins occurring endogenously in the plant cell.
21. The composition as claimed in claim 19, the BE protein being a BEI protein.
- 15 22. The composition as claimed in claim 19, the nucleic acid molecule(s) being contained in a recombinant nucleic acid molecule.
23. A host cell containing a composition as claimed in claims 19.
- 20 24. A transgenic plant cell containing a composition as claimed in claim 19.
25. A starch obtainable from cells as claimed in claim 1 or from a plant as claimed in claim 12 or from reproductive material as claimed in claim 15.
- 25 26. The starch as claimed in claim 25, which has an amylopectin content of at least 90% and a phosphate content which is increased in comparison to starch from corresponding plants of the waxy phenotype by at least 30%.
- 30 27. The starch as claimed in claim 25, which has an amylopectin content of at least 90%, a phosphate content which is increased in comparison to starch from corresponding plants of the waxy phenotype by at least 30% and/or a gelatinization temperature decreased by at least 1.0°C.

28. The starch as claimed in claim 27, which originates from potatoes.

5 29. A process for the production of a starch as claimed in claim 25 comprising the extraction of the starch from a cell as claimed in claim 1 or from a plant as claimed in claim 12 or from reproductive material as claimed in claim 15.